I strongly believe that advancement in technologies with groundbreaking innovations in the realm of Artificial Intelligence (AI), Machine Learning (ML) and Data Science (DS) holds the key to unlocking the future in any technology-driven industry. These fields have endless potential for research as breakthroughs in these fields are occurring at an exponential rate. I am convinced that these domains are an important area and will have many more implications across various industries in the coming decades and wish to be on the forefront of the research happening in the domain. With dedication, persistence and hardworking mindset and strong proclivity for research I am deeply inspired to apply and be part of the institution.

A technology enthusiast since my time at school with being awarded a medal for being in top 10 students of our entire science, mathematics and computer science cohort for securing 90.2% demonstrating strong interest coupled with analytical skills, I grew up with an admiration for scientists and engineers alike. While I loved the idea of arriving at a result that no human had previously arrived at and admired the efforts that go into gaining that level of mastery over a subject, I was fascinated by Engineers who figured out ways to create useful applications of these findings. Initially it was Mechanical Engineering that I found fascinating and decided to pursue it for my undergraduate program. As the semesters went by, I began learning about programming and understand its purpose in building applications to automate tasks and additionally researched on the software architecture of certain mechanical design and analysis applications like ANSYS, Autodesk and SolidWorks which helped me reach finalist positions in competitions to showcase works on those applications and secure certification. This led me to complete courses in computer graphics for product design and modelling, advanced mechatronics, C and C++ programming and building applications for numerical methods computation. With a CGPA of more than 9, I was consistently amongst the top percentile of students in the department.

In my final year of undergraduate studies, I was exposed and inspired by the work of well-known research scientists in the domain of nonlinear dynamic systems and structures based on the paper A hybrid nonlinear vibration energy harvester. What fascinated me was the intensity of their analytical framework that helped me understand how to take an idea from its inception and formulate a mathematical model to make the scientific case for the study. Fortunately, I was able to contact the original researchers when I needed some clarification on their advanced computational architecture Method of Multiple Scales (MMS). Working and collaborating with this team which included the original researchers, my research professor Rabindra Kumar Behera, and a PhD scholar; we were able to unpack the process by which they traveled from the conception of the idea and design of the system to their analytical results, simulation, and numerical

analysis. This helped me to complete my undergraduate research report titled “Vibration Energy Harvesting From a Piezoelectric Cantilever Beam”. It was a joy to use their work as a model to understand how this kind of research was done and this propelled me to volunteer my time as a student researcher with my professor. With this project as the foundation, we investigated the coupled nonlinear behavior of a beam structure with a moving mass under different conditions introducing kinematic nonlinearities into the system, thereby developing a comprehensive coupled analytical nonlinear geometric model. By applying Hamilton's principle and other analytical frameworks we derived a coupled mathematical formulation of the desired system, capturing the nonlinear behavior. This led us to infer resonance phenomena and traveling waves characteristics from the simulation data and visualization and observe the influence of different boundary conditions on the dynamic response with different time and space data. This provided us with valuable insights into the dynamic properties of such systems and their potential applications in engineering design and small-scale electronic devices. This led to the publication of a paper that I authored with my professor titled “Coupled non-linear behavior of beam with a moving mass”. By the end of the project, I was convinced it was a career in research that suited me. Although this was a research project related to my field of mechanical engineering at the time, it illustrates my abilities as a researcher using simulation data analysis and developing algorithms to build a model to utilize the data from the simulation to validate analytical frameworks of the system. Additionally I also had the opportunity to complete certification in Machine Learning and Robotics specialization with project based training along with certification in building my leadership and management skills added with web development skills which helped me in understanding my interest in DS.

The intensive research experience coupled with comprehensive data analysis and visualization along with the certification courses permeated an interest in me to pursue a graduate program in Mechanical Engineering with DS and found University of Washington, Seattle had the same opportunity: I did this because I saw the opportunity to take relevant courses and pursue projects in DS along with engineering that would inform me about the world of data analytics and engineering to make decisions and inferences with AI and ML models and applications. I felt that by pursuing a masters program in engineering and data science, I could pursue and take up a career in interdisciplinary domains of DS and engineering research such as software or hardware. During my graduate program, I learned about the value of using AI to develop applications that helped to realize the depth of the domain that I was eager to learn more about. This gave me the pathway to delve into specialized domains of machine learning through PhD level courses

which included computer vision, natural language processing, deep learning, and system design with parallel computing. As part of the courses, I did literature and research studies that helped me to understand the conceptual framework of the researchers in these domains. Keen to explore a wide variety of topics and see what it was that really resonated with me, I went into every new lecture without any preconceived notions about the subject but only a curiosity to learn more about it. It is this attitude to which I attribute the affinity I developed for these courses. I also gained valuable research experience working on course research projects in various domains among which some of them are visual dynamics and physical reasoning by representation learning, deep reinforcement learning for developing trading algorithm and ML informed analysis on material science. One of the notable research projects was conducting research article study on Aspect-Based Sentiment Analysis (ABSA) to build a language model implicit sentiment classifier. The paper demonstrates data pre-training with Supervised Contrastive Pre-Training Learning (SCAPT) where data is the corpus of restaurants and laptops reviews and fine-tuned on transformer encoder and BERT models. Then based on accuracy metric, comparison was made between standalone transformer encoder and BERT models and those frameworks with SCAPT. We then experimented the model on a new dataset of BestBuy reviews achieving an average of 86% accuracy on both models with SCAPT which substantiated their results. I was also part of a computer vision course research project where we conducted a literature study and analyzed the researchers results on a lane detection model by learning from key-point features developed from each associated lane image with ResNet model having self-attention layer and encoder-decoder model. We built an algorithm by applying ResNeXt model replacing their ResNet model as the backbone architecture and finetuning the model with ImageNet dataset to achieve an average F1 score of 94%. Another project that helped me to understand concepts at system level was when we built an application with parallel computing techniques to enhance the performance of a stereoscopic depth perception algorithm. The goal was to develop an algorithm capable of determining stereoscopic depth perception with a massive number of pixel calculations, specifically 3 billion pixels. We employed CUDA and numba libraries to utilize global memory, a 2D grid, and 32 threads per block framework. The implementation of parallel computing techniques yielded remarkable results, enhancing the computation time by 147x compared to the sequential algorithm due to the effective distribution of computational tasks across multiple processors. Furthermore, higher accuracy of approximately 85% in determining stereoscopic depth perception validated the effectiveness of the parallel computing approach. This project helped me to grasp complex computational problems and devise methods using parallel computing techniques with GPU utilization, memory allocation and management, algorithm optimization and high-performance computing.

To complement my academic program and in addition to my research experience, I also had the opportunity working as a data scientist at a startup organization where I worked on developing features to improve the accuracy of search and recommendation algorithm and as a machine learning intern at Chubb where I worked on building ML applications for language inference and translation, entity detection, knowledge graph, information extraction, document classification and summarization. One notable project at Chubb was the development of an anomaly detection (AD) model to predict outliers in the data. I conducted research article study on ADBench paper which provided detailed study on various anomaly detection models like linear, proximity-based, ensembles, neural nets and graph-based models in supervised, semi-supervised and unsupervised cases and then decided on a probabilistic unsupervised learning model based on the research article ECOD. This model was selected due to its unsupervised learning architecture, capability of the model to be applied to large dataset of varying distribution without compromising performance and computational time and cost as its independent of the number of features and due to its easier scalability and maintainability feature. I was able to use more than half a million data points on the model for initial case study for training and testing and saw promising results where the model was detecting data points greater than a certain threshold as anomaly and achieving an accuracy of 83%. My application reflects my interest in asking questions, persisting and being willing to engage in a variety of creative methods that enable me to utilize technology to address important real-world problems and a commitment to engage in research using critical thinking, problem solving and collaborative work – pursuing independent and team projects which contributed to the whole. This program afforded me the chance to work in so many interesting ways with my colleagues across disciplines, along with the opportunity to work with well- established professors and scientists in computer science via courses and research projects. Besides academic and research experience, working as a student assistant on campus enabled me to meet students from other disciplines, understand and learn the latest development in AI/ML and experience the richness of campus life. It strengthened my leadership and communication skills and gave me the opportunity to show my initiative, take responsibility and share my talents in organizing events and support various diverse communities across campus. I am currently a part of an organization that supports international students, diversity and inclusive communities working with their database administration and data engineering team.

The training I received from my undergraduate and graduate institution, the internships, work, and research experience helped me realize my passion for research and led me to increase my understanding of and fueled my interest in AI. My key interest area lies in the intersection of machine learning, systems, NLP, and CV. By pursuing this position, I intend

to delve deep into these realms and understand in depth the more complex concepts that come under these topics. The wide scope of advanced research this domain has to offer and currently being leveraged for various applications in software, aerospace, robotics, healthcare, energy, sensors and actuators, high performance computing, hardware, consumer products, biomedical, automobile, manufacturing industries and many more promises multitude of opportunities. My aspiration is to pursue a career in Research and Development (R&D) undertaking the latest cutting-edge research in AI/ML and software engineering and explore new studies that have been undertaken and gain valuable hands on practical real-world experience. Additionally, I am passionate about educating the world about these technologies through academia, bootcamps and podcasts and want to be an advocate of these technologies to make it accessible and use my talent and skill to build tools for it. In the long term I see myself as a leader with a company and use my knowledge and skills to work on different projects. I have been fascinated by AI, ML, and data since I was an undergraduate student, and I am excited about the potential of these technologies to revolutionize many aspects of our lives and to be part of it. It's in R&D that I believe I can make the greatest contribution, utilizing my theoretical background and creativity.

I understand that at this point in my education and professional life, I require extensive training and development from a renowned institution to reach my goals and aspirations. The vibrant and diverse academic and talent community with its cutting-edge technological research, state of the art techniques used, distinguished faculty, partnered with leading companies, comprehensive and well-defined mission and vision promises me more opportunities in future and substantial support to pursue my passion and reach my career goals. I believe that my broad knowledge and skill set from engineering and data science background would help to drive the research in AI/ML to greater heights efficiently and productively.

I assure the admission committee that I will endeavor to surpass the expectations set forth for an incoming applicant and uphold the noble ideas that have been the cornerstone of this esteemed institution. I look forward to being part of this acclaimed institution and learn, share, and grow as a member of your vibrant scholastic community.